AEC-NASA TECH BRIEF

Reaction of Steam with Molybdenum Is Studied

A comprehensive report has been prepared on the reaction of flowing steam with refractory metals (in particular molybdenum), in the temperature range of 1100° to 1700°C. The reaction products are hydrogen gas and the vapor of $(MoO_3)_n$ and $MoO_2(OH)_2$. The surface of the molybdenum shows a thin film of lower oxide, which is oxidized by the steam to a volatile oxide.

The experimental method entailed passing steam over an inductively heated sample of metal, then passing the products through a condenser to remove the aqueous solution, and collecting the gas evolved in a eudiometer.

It was found that with constant steam flow, the reaction rate is constant. The velocity constants, expressed in gram atoms of molybdenum reacted per square centimeter of surface per minute, vary from 6×10^{-4} at 1700° to 2×10^{-6} at 1130°C. To determine the effect of flow rate on the velocity constant, quartz tubes of different diameters were used with specimens of different diameters, allowing for variations in flow rate. A tenfold change in flow rate resulted in less than a factor of 2 in velocity constant.

The report, *Studies of Metal-Water Reactions at High Temperatures: I. The Condenser Discharge Experiment: Preliminary Results with Zirconium,* by L. Baker, Jr., R. L. Warchal, R. C. Vogel, and M. Kilpatrick, ANL-6257, Argonne National Laboratory, May 1961, includes information about the experimental procedures, apparatus, preparation of samples, results, and a comprehensive discussion of the experiment.

Notes:

1. This information should be of interest to physical chemists and mechanical engineers concerned with high pressure steam system design.
2. Additional details are contained in *Journal of Physical Chemistry 69,* 1965, p. 1638–1640.
3. Inquiries concerning this innovation may be directed to:

   Office of Industrial Cooperation
   Argonne National Laboratory
   9700 South Cass Avenue
   Argonne, Illinois 60439
   Reference: B67-10502

   Source: M. Kilpatrick and S. Lott
   Chemical Engineering Division
   (ARG-295)

Patent status:

Inquiries about obtaining rights for commercial use of this innovation may be made to:

Mr. George H. Lee, Chief
Chicago Patent Group
U.S. Atomic Energy Commission
Chicago Operations Office
9800 South Cass Avenue
Argonne, Illinois 60439

Category 03